What is claimed is:

1. A method for determining the maximum acceleration and deceleration limits for the longitudinal or lateral axis of an aeronautical vehicle while maintaining a constant vertical state, said vehicle having a vertical control inceptor, said method comprising:

determining a vertical inceptor position required to maintain a vertical state, and

determining minimum and maximum allowable vertical inceptor position limits for desired operation of the vehicle.

2. The method as stated in claim 1 wherein said acceleration and deceleration limits are pitch and roll attitude limits.

3. The method as stated in claim 2 wherein said acceleration and deceleration limits are predicted increases or decreases in the pitch and roll attitude limits.

4. The method as stated in claim 3 wherein said limits are represented as control inceptor position limits on said longitudinal and lateral axes.

5. The method as stated in claim 4 wherein said limits are provided as tactile cues.

6. The method as stated in claim 4 wherein said limits are provided through an active force cueing system.

7. The method as stated in claim 1 wherein said limits are cued through an aural, visual or tactile cueing system.

8. The method as stated in claim 1 wherein said limits are provided to a software limiting system.

9. The method as stated in claim 1 wherein said limits are based on the transfer of potential and kinetic energy.

10. The method as stated in claim 1 wherein said limits are based on the potential change in vertical velocity.

11. The method as stated in claim 1 wherein said limits are determined using at least two methods, and the most restrictive result from the two methods are utilized.

12. The method as stated in claim 1 wherein said vertical state is holding constant vertical altitude.

13. The method as stated in claim 1 wherein said vertical state is holding constant vertical velocity.

14. The method as stated in claim 1 wherein said vertical state is holding constant flight path angle.

15. The method as stated in claim 1 wherein said limits are determined by the rotor torque required to balance the gravitational forces for non-zero pitch or roll attitude.

16. The method as stated in claim 1 wherein said vertical inceptor position is a predicted position based on vehicle performance and operator inputs.

17. The method as stated in claim 1 wherein said vertical inceptor position is based on a feedback loop of

error between the desired vertical state and the measured performance.

18. The method as stated in claim 1 wherein said minimum and maximum vertical inceptor position limits are based on predictions of vehicle performance.

19. The method as stated in claim 1 wherein said minimum and maximum vertical inceptor position limits are based on feedback between known limits and measured performance.

20. The method as stated in claim 1 wherein said minimum and maximum vertical inceptor position limits are based on one or more of the following group comprising:

transmission torque, engine torque, main rotor torque, main rotor overspeed, main rotor underspeed, main rotor stall, encroachment upon vortex ring state conditions, encroachment upon power setting condition, vertical velocity limits, actuator position limits and actuator rate limits.

21. A method for maintaining a constant vertical state of an aeronautical vehicle with a vehicle controller, said method comprising the steps of:

determining a plurality of operating parameters for the aeronautical vehicle, said operating parameters being selected from the group comprising airspeed, torque, rotor speed, pitch attitude, roll attitude, vertical velocity, and rate of change of altitude;

providing said determinations of said plurality of operating parameters to the vehicle controller;

determining the maximum and minimum limits of each of said plurality of operating parameters;

providing said determining maximum and minimum limits to the vehicle controller; and

preventing said determined maximum and minimum limits from being exceeded in the aeronautical vehicle by the vehicle controller.

22. A constant vertical state maintaining cueing system for a vehicle comprising:

an inceptor having a minimum inceptor position and a maximum inceptor position;

an airspeed sensor generating an airspeed signal;

at least one attitude sensor generating an attitude signal; and

a controller electrically coupled to said airspeed sensor and said at least one attitude sensor, said controller determining a vertical inceptor position for maintaining a constant vertical state and generating a cueing signal for maintaining said constant vertical state in response to said airspeed signal, said attitude signal, said minimum inceptor position, and said maximum inceptor position.

23. The system as in claim 22 further comprising:

a vertical velocity sensor generating a vertical velocity signal; and

a torque sensor generating a torque signal;

said controller electrically coupled to said vertical velocity sensor and said torque sensor, said controller also determining said vertical inceptor position to maintain said vertical state in response to said vertical velocity signal and said torque signal.

24. The system as in claim 22 wherein said controller in generating said cueing signal determines the amount of vertical velocity change and amount of torque change in response to changes in inceptor position.

25. The system as in claim 22 further comprising an active control inceptor system, said active control inceptor system having a plurality of positions and a position sensor coupled to said control inceptor and generating a control inceptor position signal, wherein said controller generates said cueing signal in response to said control inceptor position signal.

26. The system as in claim 25 wherein said controller indicates said cueing signal via a cueing indicator other than said active control inceptor system.

27. The system as in claim 22 wherein said cueing signal is in the form of a signal selected from the group consisting of a tactile cueing signal, a stick shaker cueing signal, a visual cueing signal, and an aural cueing signal.

28. The system as in claim 22 wherein said controller generates a vehicle control signal in response to said cueing signal.

29. The system as in claim 22 wherein said controller generates at least one vehicle flight profile in response to said cueing signal.

30. The system as in claim 22 wherein said controller in generating said cueing signal determines at

least one pitch attitude limit and at least one roll attitude limit.

31. The system as in claim 30 wherein said controller in determining at least one pitch attitude limit sets a roll attitude value to be constant.

32. The system as in claim 30 wherein said controller in determining at least one roll attitude limit sets a pitch attitude value to be constant.

33. The system as in claim 22 wherein said controller in generating said cueing signal determines the maximum change in pitch attitude.

34. The system as in claim 22 wherein said controller uses limits determined in generating said cueing signal in performing system tasks other than in maintaining said constant vertical state.

35. The system as in claim 22 wherein said controller in generating said cueing signal determines maximum change in roll attitude.

36. The system as in claim 22 wherein said controller in generating said cueing signal determines pitch attitude limits while maintaining said constant vertical state.

37. The system as in claim 22 wherein said controller in generating said cueing signal determines roll

attitude limits as to be able to maintain said constant vertical state.

38. The system as in claim 22 wherein said controller in generating said cueing signal determines pitch attitudes using conservation of energy relationships.

39. The system as in claim 22 wherein said controller in generating said cueing signal determines pitch attitudes and roll attitudes using conservation of energy based relationships.

40. The system as in claim 39 wherein said conservation of energy based relationships relate pitch attitudes limits and roll attitudes limits to vertical controller parameters.

41. The system as in claim 39 wherein said conservation of energy based relationships relate pitch attitudes limits and roll attitudes limits to torque.

42. The system as in claim 22 wherein said controller in generating said cueing signal determines pitch attitudes and roll attitudes using thrust and gravitational force based relationships.

43. The system as in claim 42 wherein said thrust and gravitational force based relationships relate pitch attitudes limits and roll attitudes limits to torque.

44. The system as in claim 22 wherein the maximum torque is assumed to be substantially 100% when generating said cueing signal.

45. The system as in claim 22 wherein said controller performs software limiting tasks when generating said cueing signal.

46. The method of cueing a vehicle operator of maximum accelerations and decelerations that may be performed during a constant vertical state without disengagement therefrom comprising;

generating an airspeed signal;

generating an attitude signal;

determining a vertical inceptor position to maintain a vertical state; and

generating a cueing signal to maintain a constant vertical state in response to said airspeed signal, said attitude signal, a minimum inceptor position, and a maximum inceptor position.

47. The method as in claim 46 further comprising:

generating a vertical velocity signal;

generating a torque signal; and

determining said vertical inceptor position to maintain a vertical state in response to said vertical velocity signal and said torque signal.

48. The method as in claim 46 wherein generating said cueing signal, the amount of vertical velocity change and the amount of torque change are determined in response to changes in inceptor position.

49. A method as in claim 46 further comprising:

generating a control inceptor position signal; and

generating said cueing signal to maintain the constant vertical state in response to said control inceptor position signal.

50. A method as in claim 96 wherein generating a cueing signal comprises determining a maximum change in pitch attitude and a maximum change in roll attitude using conservation of energy based relationships.

51. A method as in claim 46 wherein generating a cueing signal comprises determining a maximum change in pitch attitude and a maximum change in roll attitude using thrust and gravitational force based relationships.

52. A method as in claim 46 wherein generating a cueing signal comprises:

determining a first maximum change in pitch attitude and a first maximum change in roll attitude using a conservation of energy relationship;

determining a second maximum change in pitch attitude and a second maximum change in roll attitude using a thrust and gravitational force based relationship;

comparing said first maximum change in pitch attitude to said second maximum change in pitch attitude and cueing which ever maximum change in pitch attitude that is smaller in magnitude; and

comparing said first maximum change in roll attitude to said second maximum change in roll attitude and

cueing which ever maximum change in roll attitude that is smaller in magnitude.

53. A method as in claim 46 wherein when generating a cueing signal a minimum nose down pitch attitude for traveling velocities less than a predetermined velocity is used.

54. A method as in claim 46 wherein when generating a cueing signal a negative maximum acceleration limit is used when a current flight path angle has caused a vertical maneuvering limit to be exceeded.

55. A constant vertical state maintaining cueing system for a vehicle comprising:

an inceptor having a minimum inceptor position and a maximum inceptor position;

an airspeed sensor generating an airspeed signal;

at least one attitude sensor generating an attitude signal; and

a controller electrically coupled to said airspeed sensor and said at least one attitude sensor, determining a vertical inceptor position to maintain a constant vertical state and generating a cueing signal to maintain said constant vertical state in response to said airspeed signal, said attitude signal, said minimum inceptor position, and said maximum inceptor position;

wherein said controller in generating said cueing signal determines pitch attitudes and roll attitudes using conservation of energy based relationships and thrust and gravitational force based relationships.

56. A system for determining the maximum acceleration and deceleration that can be achieved on either the longitudinal or lateral axis of an aeronautical vehicle while maintaining a constant vertical state, said system comprising:

a plurality of vehicle performance sensors; and

a controller that calculates the vertical control inceptor position required to maintain a desired vertical state, and the maximum and minimum vertical control inceptor positions.

57. The system as in claim 56 wherein said acceleration and deceleration limits are represented as pitch and roll attitude limits.

58. The system as in claim 56 wherein said acceleration and deceleration limits are represented as an allowable increase or decrease in pitch or roll attitude.

59. The system as in claim 58 wherein said limits are represented as stick position limits.

60. The system as in claim 59 wherein said calculated limits are cued to tactile cues using an active force cueing system.

61. The system as in claim 56 wherein said calculated limits are cued to an aural, visual, or other cueing methods.

62. The system as in claim 56 wherein said calculated limits are utilized by a flight control computer for software limiting.

63. The system as in claim 56 wherein said calculated limits are based on the transfer of potential and kinetic energy.

64. The system as in claim 56 wherein said calculated limits are based on the potential change in vertical velocity.

65. The system as in claim 56 wherein said calculated limits are calculated using at least two methods and the most restrictive result is used.

66. The system as in claim 56 wherein said calculated limits are based on the rotor thrust or torque required to balance the gravitational forces for non-zero pitch or roll attitudes.

67. The system as in claim 56 wherein the desired vertical state is holding constant altitude.

68. The system as in claim 56 wherein the desired vertical state is holding constant vertical velocity.

69. The system as in claim 56 wherein the desired vertical state is holding constant flight path angle.